SECTION 28 3100

FIRE DETECTION AND ALARM

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LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the ESM Fire/Electrical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within “stars” during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Design, furnish, install, test, certify, and place into service a complete addressable fire alarm system. The system shall be complete with all hardware, software, and memory specifically tailored for this installation.

B. Provide a fire alarm system consisting of, but not limited to the following components:

1. Fire alarm control panel (FCP)

2. Conduit and wiring necessary to connect the FCP to alarm initiating devices, notification appliances and auxiliary equipment

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Edit 3 through 13 to match project fire alarm system requirements.

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3. Addressable manual fire alarm stations

4. Addressable analog area smoke detectors

5. Addressable analog duct smoke detectors

6. Addressable analog heat detectors

7. Connections to sprinkler waterflow alarm switches

8. Connections to sprinkler supervisory switches and tamper switches

9. Sounder and signal strobe combination notification appliances

10. Air handling systems shutdown relays

11. Elevator recall/shunt relays (if the building has an elevator)

12. Battery standby

13. Conduit and GFE cable to building's main telecommunications room

C. Provide a fire alarm system that conforms to the requirements of NFPA 72-2002, National Fire Alarm Code, the 2002 National Electrical Code, ASME A17.1, Safety Code for Elevators and Escalators, and NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.2 SYSTEM FUNCTIONAL DESCRIPTION

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Edit system functional description to match the project fire alarm system requirements. Projects with high explosives areas or NEC Article 500 hazardous locations will require additional specialized equipment and system characteristics not included in this specification.

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A. The system shall identify any off normal condition and log each condition into the system database as an event.

1. The system shall automatically display on the control panel the first event of the highest priority by type. The priorities and types shall include alarm, supervisory, and trouble.

2. The system shall have a queue operation, and shall not require event acknowledgment by the system operator. The system shall have a labeled color-coded indicator for each type of event.

3. The user shall be able to review each event by selecting scrolling keys.

4. New alarm, supervisory, or trouble events shall sound a silenceable audible signal at the control panel.

B. Operation of any alarm-initiating device shall automatically:

1. Update the control/display as described above.

2. Audibly and visibly annunciate the alarm condition at the fire alarm control panel.

3. Sound all alarm signals throughout the building. The fire alarm evacuation tone shall be the three-pulse temporal pattern.

4. Turn on all strobe lights throughout the building.

5. Operate the alarm relay and initiate the transmission of an alarm signal to the LANL central station over a digital alarm communicator system.

6. Operate control relay contacts to shut down all HVAC units serving the floor of alarm initiation.

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Delete 7 and 8 if there is no elevator.
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7. Operate control relay contacts to return all elevators that serve the floor of alarm initiation to the ground floor. If the alarm originates from the ground floor, operate control circuits contacts to return all elevators to the floor above or to a level as directed by the LANL Fire Protection Group.

8. Shut down power to elevator equipment before sprinkler operation in the elevator equipment room.

C. Activation of a supervisory initiating device shall:

1. Update the control/display as described above.

2. Audibly and visibly annunciate the supervisory condition at the fire alarm control panel.

3. Operate the supervisory relay and initiate the transmission of a supervisory signal to the LANL Central Station over a digital alarm communicator system.

D. The entire fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens, grounds or disarrangement of system wiring and shorts across alarm horn/strobe wiring shall automatically:

1. Update the control/display as described above.

2. Operate the trouble relay contacts to initiate the transmission of a trouble signal to the LANL central station over a digital alarm communicator system.

3. Visually and audibly annunciate a general trouble condition, on the FCP. The visual indication shall remain on until the trouble condition is repaired.

1.3 SYSTEM DESIGN

A. System Design: Provide the services of a qualified factory trained fire alarm designer for the FCP to be installed on this project. The designer shall assure the completeness and correctness of the fire alarm system design by performing the following:

1. Prepare shop drawings of FCP indicating location of components, interconnection of components and connections to alarm initiating, indicating, and auxiliary circuits.

2. Prepare a system input/output matrix to verify that the proper sequences occur for each initiating point or zone.

3. Prepare shop drawings of fire alarm layout, conduit and wiring plans. Show location of all fire alarm appliances, conduit layout, quantity, and type of wires in each conduit, and interface with other systems for functions such as central station signaling, fan shutdown, damper operation, and elevator recall.

4. Prepare terminal-to-terminal field wiring diagrams for alarm initiating, indicating and auxiliary circuits; detail the interfaces with other systems; indicate labeling of each fire alarm system conductor.

5. Calculate conductor sizes for each alarm initiating, indicating, and auxiliary circuit; limit voltage drops so that they do not exceed the FCP manufacturer's limitations, for the most remote device on each circuit.

6. Prepare battery load calculations for the FCP and any remote power supply panels and select proper battery size.

7. Calculate alarm signal in all spaces to comply with ADAAG requirements: minimum 15 dBA above ambient at all locations, but not over 120 dBA at any location.

8. Select alarm initiating, alarm indicating, and auxiliary devices compatible with FCP.

1.4 SUBMITTALS

A. Provide the following submittals according to the requirements of Section 01 3300, Submittal Procedures:

1. Calculations: Submit the following calculations at least 30 days prior to scheduled start of fire alarm system installation.

   a. System battery capacity calculations to demonstrate that the battery is sized to support the system for not less than 24 hours of supervisory and trouble signal current plus general alarm for not less than 10 minutes following the completion of the 24 hour period.

   b. Audible signal distribution calculations to demonstrate that the notification appliances are selected and located so fire alarm signal sound intensity levels in all occupied areas will be not less than those required by NFPA 72.

   c. Voltage drop calculations to demonstrate that the signal voltage at the most remote notification appliances on each circuit will not be less than the FCP or the notification appliance manufacturer's recommendations.

   d. Submit final battery capacity calculations and final voltage drop calculations at least one week prior to final system acceptance test.

2. Catalog Data: Submit catalog data at least 30 days prior to scheduled start of fire alarm system installation for all equipment furnished under this Section.

3. Certifications: Submit certifications as follows:

    a. Within 30 days after Notice to Proceed, submit certifications of the qualifications of the fire alarm installing firm as described in the quality assurance paragraph of this Section.

    b. Within 30 days after Notice to Proceed, submit certifications of the qualifications of the fire alarm system technician as described in the quality assurance paragraph of this Section.

    c. Provide certification from the fire alarm control manufacturer that proposed alarm-initiating devices, alarm appliances, and auxiliary devices are compatible with the FCP and other auxiliary equipment.

    d. Provide "Record of Completion" and associated documentation for the completed system according to NFPA 72 prior to the system acceptance test.

4. Installation Instructions: Submit installation instructions at least 30 days prior to scheduled start of fire alarm system installation.

5. Materials and Parts List: Submit materials and parts list at least 30 days prior to scheduled start of fire alarm system installation.

6. Shop Drawings: Submit system shop drawings as follows:

    a. Prepare floor plan drawings using a minimum scale of 1/8" - 1'0" for plans and 1/4" = 1'-0" for details.

    b. Hand lettering shall be a minimum of 3/16" and other lettering a minimum of 1/8" to permit microfilm reductions.

    c. Show location of FCP, all fire alarm appliances, conduit layout, quantity and type of wires in each conduit, and interface with other systems for functions such as central station signaling, fan shutdown, damper operation, and elevator recall.

    d. Show layout of the FCP indicating location of components, interconnection of components, and connections to alarm initiating, indicating, and auxiliary circuits.

    e. Submit shop drawings at least 30 days prior to scheduled start of fire alarm system installation. Installation shall not proceed without design approval by the LANL Fire Protection Group.

    f. Submit final shop drawings at least one week prior to final system acceptance test.

7. FCP Program: Submit FCP program as follows:

    a. Provide the FCP input/output matrix and a copy of the proposed FCP program at least 30 days prior to the anticipated final tie-in/acceptance date of the fire alarm system.

    b. Provide the final FCP input/output matrix and the final FCP program at least two weeks prior to the anticipated final tie-in/acceptance test.

8. Test Reports: Submit test reports as follows:

    a. Submit a report of the pre-final tests indicating system status and corrective actions required before the final acceptance tests.

    b. Submit a test plan for the final acceptance tests at least 30 days prior to scheduled final acceptance tests.

    c. Submit a report of final acceptance tests according to requirements in NFPA 72.

9. Wiring Diagrams: Submit wiring diagrams as follows:

    a. Provide terminal-to-terminal wiring diagrams for alarm circuits, supervisory circuits, remote power supply panels, and interfaces with other systems such as HVAC and elevators.

    b. Submit wiring diagrams at least 30 days prior to scheduled start of fire alarm system installation.

    c. Submit final wiring diagrams at least one week prior to final acceptance testing.

10. O&M Manual: Submit operating and maintenance data.

    a. Submit operating and instruction manuals prior to testing of the system.

    b. Submit four complete sets of project-specific operating and maintenance instruction manuals upon successful completion of testing. Provide complete, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each piece of equipment, and a complete trouble shooting manual explaining how to test the primary internal parts of each piece of equipment. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:

        i. Provide instructions for replacing any components of the system, including internal parts.

        ii. Provide a list of recommended spare parts.

iii. Provide instructions for periodic cleaning and adjustment of equipment with a schedule of these functions.

iv. Provide a complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.

c. Provide operating instructions prominently displayed on a separate sheet located next to the FCP in accordance with UL Standard 864.

11. Project Record Documents: Submit project record documents as follows:

a. Provide updated shop drawings reflecting as-built conditions showing the work completed under this Section. Include notes on special systems or devices, new and existing, locations of equipment, actual conduit installation, wiring color-coding, wire tag notations, interconnections between all equipment, and internal wiring of the equipment. Include conduit size, conductor size, and number of conductors per conduit.

b. Provide the updated shop drawings on Mylar reproducible media and on electronic media in AutoCAD “*.dxf” or “*.dwg” format.

12. Warranties: Submit warranties. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for one year (365 days) from the date of final acceptance.

1.5 QUALITY ASSURANCE

A. Qualification of the Installing Firm: The installing firm shall:

1. Be licensed by any state in the United States to engage in the design, fabrication, and installation of fire alarm systems.

2. Have satisfactorily installed at least twenty fire alarm systems of equivalent nature and scope to the system described in this Section.

3. Provide the services of a qualified fire alarm system technician to design the fire alarm system and to test the completed system.

4. Be a factory-certified representative of the manufacturer of the FCP that will be used on this project.

B. Qualifications of the fire alarm system technician: The fire alarm system technician shall:

1. Be factory trained in the theory, operation, installation, and troubleshooting of the FCP that will be used for this project.

2. Have satisfactorily designed at least twenty fire alarm systems of equivalent nature and scope to the system described in this Section.

3. Have satisfactorily field-tested at least twenty fire alarm systems of equivalent nature and scope to the system described in this Section.

4. Be NICET (National Institute for Certification in Engineering Technologies) Fire Alarm Certified, or certified by an equivalent organization acceptable to the LANL Fire Authority Having Jurisdiction.

1.6 PRODUCT HANDLING

A. Materials and Equipment: Protect materials and equipment from damage during shipping, storage, and installation.

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Add special product handling requirements for the facility in which this system is to be installed.
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PART 2 PRODUCTS

2.1 GENERAL

A. Provide materials and equipment that are new and unused, free of defects, specifically designed for the use intended, conform to the requirements of the NEC and NFPA 72, and are NRTL listed for the intended use.

B. Provide products suitable for operation at an elevation of 7,500 ft.

2.2 FIRE ALARM CONTROL PANEL

A. The fire alarm control panel (FCP) shall incorporate all control electronics, relays, and necessary modules and components in a flush or semi-flush mounted cabinet (dependent on FCP mounting location). The operating controls and zone/supervisory indicators shall be located behind locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified. The assembly shall contain a base panel, system power supply and battery charger with additional modules to meet the requirements of these specifications.

B. System circuits shall be configured as follows: Addressable analog loops Class B/Style 4; Initiating Device Circuits (if used) Class B/Style B; Notification Appliance Circuits Class B/Style Y.

C. The system shall store all basic system functionality and job specific data in non-volatile memory. The system shall survive a complete power failure intact.

D. The system shall have built-in automatic system programming to automatically address and map all system devices and provide a minimum default single stage alarm system operation with support of alarm silence, trouble silence, drill, lamp test, and reset common controls.

E. The system shall allow down loading of a job specific custom program created by system application software. It shall support programming of any input point to any output point.

F. The system shall support distributed processor intelligent detectors with the following features: integral multiple differential sensors, automatic device mapping, electronic addressing, environmental compensation, pre-alarm, dirty detector identification, automatic day/night sensitivity adjustment, dual normal/alarm LEDs, relay bases, and isolator bases.

G. The system shall use full digital communications to supervise all addressable loop devices for placement, correct location, and operation. It shall allow swapping of "same type" devices without the need of addressing and impose the "location" parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.

H. The system shall have a nationally recognized testing laboratory (NRTL) listed detector sensitivity test feature, which will be a function of the smoke detectors and performed automatically.

I. All panel modules shall be supervised for placement and initiate a trouble signal if damaged or removed.

J. The system shall have a CPU monitoring circuit to initiate a trouble signal should the CPU fail.

K. The system evacuation signal rate shall be suitable to support audio-visual combination-type electronic three pulse temporal pattern sounder and strobe combination units.

L. The system program shall meet the requirements of this project, current codes and standards, and satisfy the LANL Fire Authority Having Jurisdiction.

M. Passwords shall protect any changes to system operations.

N. The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc for notification appliance circuits. All outputs shall be power limited. The battery shall be sized to support the system for 24 hours of supervisory and trouble signal current plus general alarm for 10 minutes.

O. The FCP shall have a high contrast, alphanumeric display to show system status, alarm information, and supervisory information. The FCP shall have LED indicators for the following common control functions; AC Power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be control keys and visual indicators for; reset, alarm silence, trouble silence, and drill.

P. Battery boxes, if required, shall be UL Listed for the purpose.

Q. The FCP shall have a digital alarm communicator transmitter (DACT) module to transmit detailed alarm, supervisory and trouble signals to a digital alarm communicator receiver (DACR) at a Central Monitoring Station.

1. The DACT shall support dual telephone lines, ”contact ID” communications format, and configured for dual tone multi-frequency (DTMF).

2. The DACT shall be listed for “Central Station Fire Service” and for “Proprietary Station Fire Service” and shall be of the same manufacturer as the control panel.

3. The DACT shall transmit the following information to the LANL Central Station:

   - Fire alarm per point addressable device (e.g., detector or water flow activation, manual pull stations, etc.)
   - Supervisory signal per addressable device (e.g., valve tamper)
   - General System Trouble (alarm panel trouble)
     – Loss of AC Power
     – Communication Line Failure (Primary and Backup)
     – Trouble per zone or point addressable device

4. Restoration of each signal condition identified above shall be transmitted to the LANL Central Station.

5. The secondary telephone line shall only be utilized for signal transmission in the event that attempts to communicate utilizing the primary line are unsuccessful.

6. The secondary telephone line shall have the same account code and communication format as the primary line.

7. A general alarm or supervisory signal shall not be transmitted by the DACT when specific point/zone information is transmitted.

8. Loss of AC power shall be transmitted 6 hours after the detected failure.

9. A test signal shall be sent once every 24 hours.

10. For consistency, telephone wire color configuration shall be as follows:

1 - four pair wire (Preferred Method)

To DACT				To Premise Telephone			
Cable 1		Cable 2		Cable 1		Cable 2	
Tip 1	Ring 1	Tip 2	Ring 2	Tip House 1	Ring House 1	Tip House 2	Ring House 2
White/Blue	Blue/White	White/ Green	Green/ White	White/Orange	Orange/White	White/ Brown	Brown/ White

2 - two pair wire

To DACT				To Premise Telephone			
Cable 1		Cable 2		Cable 1		Cable 2	
Tip 1	Ring 1	Tip 2	Ring 2	Tip House 1	Ring House 1	Tip House 2	Ring House 2
Green	Red	Green	Red	Black	Yellow	Black	Yellow

M. Manufacturers: EDWARDS “EST QUICK-START” MODEL QS-4, NOTIFIER “NFS 640,” NO SUBSTITUTIONS.

2.3 ADDRESSABLE THERMAL DETECTORS

A. Provide addressable, intelligent, rate-of-rise thermal detectors that are compatible with and acceptable to the FCP manufacturer.

1. The detector shall alarm at 135°F or a temperature rise exceeding 15°F per minute. The thermal detector shall be rated for ceiling installation at a minimum of 70 ft centers and be suitable for wall mount applications. For applications requiring other than 135 °F, consult the LANL Fire Protection Group.

B. Manufacturers: “EST SIGA-HRS” or Notifier “FST-751”.no substitutions.

2.4 ADDRESSABLE PHOTOELECTRIC DETECTORS

A. Provide addressable, analog, intelligent, photoelectric type smoke detectors that are compatible with and acceptable to the FCP manufacturer.

1. The photoelectric detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications.

B. Manufacturers: “EST SIGA-PS” or NOTIFIER “FSP-751” NO SUBSTITUTIONS.

2.5 DETECTOR MOUNTING BASES

A. Provide standard detector mounting bases suitable for mounting on 3-1/2” or 4” octagon box and 4” square box. The base shall contain no electronics and support all detector types. Removal of the detector shall not affect communications with other detectors.

B. Manufacturers: EST “SIGA-SB” or Notifier “B710LP Low profile base” no substitutions.

2.6 DUCT SMOKE DETECTOR AND HOUSING

A. Provide addressable photoelectric duct smoke detectors that are compatible with and acceptable to the FCP manufacturer and listed for the maximum air flow velocity anticipated.

B. Provide smoke detector duct housing assemblies to facilitate mounting an intelligent analog photoelectric detector along with a standard relay or isolator detector mounting base. Provide for variations in duct air velocity between 300 and 4000 feet per minute. Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream. Provide drilling templates and gaskets to facilitate locating and mounting the housing. Finish the housing in baked red enamel.

C. Where a duct detector is installed in a concealed location, more than 10 ft above the finished floor, or in an arrangement where the detector alarm indicator is not readily visible to responding personnel, the detector shall be provided with a remote alarm indicator. Remote alarm indicator shall be installed in a readily accessible location and shall be clearly labeled to indicate its function.

D. Provide duct detector wiring so that detector can be reset at FCP.

E. Manufacturers: EST “SIGA-DH” or Notifier “FSD-751P” no substitutions.

2.7 AUTOMATIC SPRINKLER SYSTEM

A. Refer to Section 21 1313, Wet-Pipe Sprinkler Systems, for pressure switches, flow switches and valve supervisory switches associated with the automatic sprinkler system.

B. Provide INTELLIGENT single input or dual input modules as required to connect PRESSURE SWITCHES, FLOW SWITCHES, AND VALVE SUPERVISORY SWITCHES TO THE ADDRESSABLE ANALOG LOOP. Each input shall provide a supervised Class B input circuit.

C. Manufacturers: EST “SIGA-CT1” single-input, EST “SIGA-CT2” dual-input or Notifier “FlashScan Monitor Module FMM-1” or “FDM-1 FlashScan dual monitor module”, no substitutions.

2.8 ADDRESSABLE MANUAL PULL STATIONS

A. Provide addressable double-action, non-coded manual pull stations that are acceptable to the FCP manufacturer and are compatible with the FCP.

B. The fire alarm station shall be of Lexan or metal construction with an internal toggle switch. Provide a key locked test feature. Finish the station in red with white “PULL IN CASE OF FIRE” lettering. The manual station shall be suitable for mounting on 2-1/2” deep 1-gang boxes and 1-1/2” deep 4” square boxes with 1-gang covers.

C. Provide the appropriate back boxes and mounting plates for flush-mounting or surface mounting (depending on the building construction).

D. Manufacturers: EST “SIGA 278” or Notifier “NBG-12LX” no substitutions.

2.9 ADDRESSABLE CONTROL RELAY MODULES

A. Provide addressable control relay modules that are acceptable to the FCP manufacturer and are compatible with the FCP.

B. The control relay module shall provide one form “C” dry relay contact rated at 2 amps at 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.

C. Manufacturers: EST “SIGA-CR” or Notifier “FRM-1” no substitutions.

D. Provide additional relays with voltage and current ratings as required to perform functions such as air handling system shutdown and elevator recall.

2.10 SOUNDER AND SIGNAL STROBE COMBINATION DEVICES

A. Provide NRTL listed 24 VDC audio-visual combination-type electronic three-pulse temporal pattern sounder and strobe combination units that are acceptable to the FCP manufacturer and are compatible with the FCP.

B. Sounder shall include three-pulse temporal pattern generating electronics, audio transducer, and screw terminals housed in a red housing. Acoustical output shall meet requirements of UL 464. The audible signal shall be the “American National Standard Audible Emergency Evacuation Signal” (three-pulse temporal pattern) in accordance with ANSI S3.41, *Audible Emergency Evacuation Signal*.

C. Strobe signal output and flash rate shall meet UL 1971 and ADAAG requirements. Unit shall have a xenon flash tube enclosed in a clear Lexan lens and shall produce a synchronized strobe flash. Provide strobes with flash output levels as required to meet NFPA 72 visual signal requirements for each space.

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Edit D. to match project fire alarm system requirements.

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D. Horn/strobe shall mount to a 4” x 2-1/8” deep electrical box with single device cover. Provide weatherproof wall boxes for outdoor mounting.

E. Manufacturers: EST “GENISIS” series, or Wheelock “AS” series, no substitutions.

2.11 NOTIFICATION BOOSTER POWER SUPPLIES

A. Provide notification circuit booster power supplies (as needed) that are acceptable to the FCP manufacturer and are compatible with the FCP.

B. Manufacturers: EST “BPS-10” or Notifier “ACPS-2406” no substitutions.

2.12 CONDUIT

A. Install fire alarm wiring in conduit. Minimum conduit size 3/4 inch.

B. Refer to Section 26 0553, Raceway and Boxes for Electrical Systems, for conduit systems.

2.13 JUNCTION BOXES

A. Refer to Section 26 0533, Raceway and Boxes for Electrical Systems, for junction boxes.

2.14 WIRING

A. Color Code: Use the following color code for the fire alarm system wiring:

1. Black - 120-Volt AC phase wire.
2. White - 120-Volt AC neutral wire.
3. Green - System ground wire.
4. Brown - Negative connection for strobe device.
5. Orange - Positive connection for strobe device.
6. Blue - Negative connection for horn circuit or horn/strobe combination circuit.
7. Yellow - Positive connection for horn circuit or horn/strobe combination circuit.
8. Gray - Negative conventional alarm initiating device connection.
9. Violet - Positive conventional alarm initiating device connection.
10. Black - Negative circuit connection for duct smoke detector reset, HVAC interlock, and other auxiliary connections.
11. Red - Positive circuit connection for duct smoke detector reset, HVAC interlock, and other auxiliary connections.
12. Black/Red Twisted Pair - Addressable device data loop, evacuation speaker circuit.

B. Conductors: Provide alarm and supervisory signaling system conductors that meet the requirements of Article 760 in the NEC and are NRTL listed for the type of service to which they will be subjected. Minimum conductor requirements shall be as follows:

1. Use red-jacketed NEC type FPL cable with No. 16 AWG (minimum) twisted-pair conductors for addressable devices; use shielded twisted-pair cables if required by the FCP manufacturer. Other low voltage conductors shall be type TFN, No. 16 AWG (minimum), thermoplastic insulation, and single solid copper conductor.

2. Power conductors shall be type THHN/THWN, No. 12 AWG, thermoplastic insulation, and single solid copper conductor.

3. Size conductors of the fire alarm systems as recommended by the manufacturer, based on the operating ampacity of the circuit and the permissible resistance and voltage drop characteristics that will allow proper operation of the equipment. Provide conductors selected to provide voltages within the manufacturer specification limits for the most remote fire alarm notification appliance or field device.

4. Design each addressable analog loop so device loading will not exceed 80% of loop capacity in order to leave for space for future devices.

2.15 TEST EQUIPMENT

A. Provide any special test equipment manufactured by the fire alarm equipment manufacturer for maintenance, testing, or troubleshooting.

2.16 SURGE PROTECTION

A. Provide a UL 1449 listed 120V surge protective device for the main FCP, each sub-FCP, and each booster power supply that has a 120V supply circuit.

1. Device shall be capable of absorbing a maximum single pulse of at least 6,500 amperes.

2. Clamping voltage shall not exceed 330 volts line-to neutral when tested in accordance with ANSI/IEEE C62.31 category C1/B3.

3. Manufacturer: EDCO model ”FAS-120AC” or as recommended by the FCP manufacturer.

B. Provide a UL 497B listed surge protective device for each analog initiating device signaling circuit entering/leaving each building that is monitored by the FCP.

1. Device shall be capable of absorbing a peak 8x20 microsecond current of 10,000 amperes at least 10 times.

2. Clamping voltage shall not exceed 30 volts.

3. Capacitance shall not exceed 50pf.

4. Provide matching receptacle for plug-in surge protective devices.

5. Manufacturer: EDCO model “PC642C-030LC” (protects 2 pairs) and “PCB1B” socket, or as recommended by the FCP manufacturer.

C. Provide a UL 497B listed surge protective device for each 24-volt initiating device circuit or control circuit entering/leaving each building that is monitored by the FCP.

1. Device shall be capable of absorbing a peak 8x20 microsecond current of not less than 10,000 amperes at least 10 times.

2. Clamping voltage shall not exceed 30 volts.

3. Provide matching receptacle for plug-in surge protective devices.

4. Manufacturer: EDCO model “PC642C-030” (protects 2 circuits) and “PCB1B” socket, or as recommended by the FCP manufacturer.

D. Provide a UL 497B listed surge four-wire protective device for each FCP RS-232 circuit entering/leaving each building monitored by the FCP.

1. Device shall be capable of absorbing a peak 8x20 microsecond current of 10,000 amperes at least 10 times.

2. Clamping voltage shall not exceed 20 volts for RS-232 applications.

3. Provide matching receptacle for plug-in surge protective devices.

4. Manufacturer: EDCO model “PC642C-020” with “PCB1B” socket, or as recommended by the FCP manufacturer.

E. Provide a UL 497B listed surge four-wire protective device for each FCP RS-485 circuit entering/leaving each building monitored by the FCP.

1. Device shall be capable of absorbing a peak 8x20 microsecond current of 10,000 amperes at least 10 times.

2. Clamping voltage shall not exceed 8 volts for RS-485 applications.

3. Line to line and line to ground capacitance shall not exceed 50pf.

4. Provide matching receptacle for plug-in surge protective devices.

5. Manufacturer: EDCO model “PC642C-008LC” with “PCB1B” socket, or as recommended by the FCP manufacturer.

F. Provide a UL 497B listed surge protective device for each 24-volt notification appliance circuit entering/leaving each building that is monitored by the FCP.

1. Protective device shall have a series resistance not exceeding 0.2 ohms per pair and shall be capable of carrying a continuous current of 5 amperes.

2. Device shall be capable of absorbing a peak 8/20 microsecond current of 5000 amperes and a 2000-ampere occurrence at least 50 times.

3. Clamping voltage shall not exceed 43 volts.

4. Provide matching receptacle for plug-in surge protective devices.

5. Manufacturer: EDCO model “PHC-043” (protects 2 circuits) and “PCB1B” socket, or recommended by the FCP manufacturer.

G. Provide a single point ground bus for each enclosure containing one or more surge protective devices. Manufacturer: EDCO model “TER-BUS” or as recommended by the FCP manufacturer.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Prior to installation carefully inspect the installed work of other trades, whether pre-existing or part of this project and verify that such work is complete to the point where the installation of the fire alarm system may properly commence.

B. Notify the Contract Administrator should conditions exist, not resulting from work of this project, that prohibit the installation from conforming to applicable codes, regulations, standards and the original approved design.

3.2 INSTALLATION

A. General:

1. Install the fire alarm system in accordance with the NEC, NFPA 72, and this specification.

2. Refer to Section 26 0553, Identification for Electrical Systems, for supporting device requirements for fire alarm cabinets, conduit, and equipment.

3. Verify dimensions in the field. Lay out work in the most direct and expeditious manner to avoid interference.

4. Coordinate necessary shutdowns of existing systems by notifying the Contract Administrator a minimum of seven working days before rendering such systems inoperative. Do not render inoperative, any system, without the prior approval of the Contract Administrator. The Contract Administrator will initiate and submit the LANL Fire Protection Impairment Procedure.

5. Coordinate fire alarm detectors and associated equipment with existing ceiling or roof materials, lighting, ductwork, conduit, piping, suspended equipment, structural and other building components.

6. Coordinate installation of fire alarm system with work of other trades. Protect fire alarm equipment with suitable coverings until completion of Project.

B. Device Mounting Heights:

1. Install manual pull stations with center 48 inches above finished floor.

2. Install combination audible/visual notification appliances with the bottom 80 inches above finished floor or 6 inches below ceiling, whichever is lower. In high bay type areas the devices may be installed at a maximum of 96 inches above the floor.

3. Comply with ADA Accessibility Guidelines (ADAAG) for device mounting heights and locations.

C. FCP Installation

1. Install FCP following manufacturer's written instructions, NFPA 72, and the NEC.

2. Locate the FCP in the main building lobby or entry vestibule so fire department personnel entering the building can readily access it. Coordinate location of FCP with the LANL Fire Protection Group.

3. Install FCP with top of cabinet trim 6 feet-2 inches (maximum) above finished floor. Refer to manufacturer's recommended installation height.

4. Mount FCP plumb and rigid without distortion of the box. Mount flush cabinets uniformly flush with wall surfaces.

5. Install filler plates in unused spaces in FCP.

6. At flush or semi-flush FCP stub four 1-inch empty conduits from cabinet into accessible ceiling space or space designated to be ceiling space in future. Stub four 1-inch empty conduits into raised floor space or below slabs other than slabs on grade.

7. Train conductors in cabinet gutters neatly in groups; bundle and wrap with cable ties after completion of testing.

8. Tighten electrical connectors and terminals, including grounding connections, according to the manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

D. Wiring Installation:

1. Install fire alarm system wiring in conduit raceway.

2. Do not pull wire or cable until the conduit system is complete between pull points.

3. Bundle conductors in panels and boxes into groups by service and destination.

4. Run electronic cable continuous between termination points. No splicing is permitted without prior approval from the Contract Administrator. Where

splicing is approved, use terminal strips that are acceptable to the LANL Fire Protection Group; do not use “wire nuts.”

5. Do not install AC current carrying conductors in the same raceway with the DC or digital fire alarm detection and signaling conductors.

6. Circuit each addressable analog loop so device loading shall not exceed 80% of loop capacity in order to leave for space for future devices--the loop shall have Class B operation. Where it is necessary to interface conventional devices provide intelligent modules to supervise Class B wiring.

7. Minimize the number of T-taps in fire alarm addressable data circuits and adhere to the manufacturer requirements/limitations. Make no T-Taps in notification appliance circuits. T-taps shall only be made on device terminals or on terminal strips that are acceptable to the LANL Fire Protection Group, do not use “wire nuts.”

8. Make allowances in conductor length at panels and other enclosures to permit forming the conductors neatly within the enclosures. Where wiring troughs are not provided with the enclosures, neatly cable and adequately support the wiring.

9. Ring out and identify power and control conductors before terminal connections are made. Check polarity and phasing and make changes as required before making terminal connections.

10. Test conductors for continuity and for freedom from shorts or unintentional grounds.

E. Junction Box Installation: Refer to Section 26 0533, Raceways and Boxes for Electrical Systems, for installation requirements.

F. Conduit Installation: Refer to Section 26 0533, Raceway and Boxes for Electrical Systems, for conduit installation requirements. Provide minimum 3/4” fire alarm system conduit.

G. Install sounder and signal strobe notification appliances in the following locations to obtain an audible signal level that is at least 15 dB above ambient but does not exceed 120 dB at any location:

1. Corridors

2. Conference Rooms

3. Mechanical Equipment Rooms

4. Computer Rooms

5. Enclosed Offices

6. Common Areas such as Restrooms (strobes only).

7. Use a strobe-only device in the vicinity of the FCP.

H. Surge Protective Device Installation

1. Install a 120V surge protective device for the main FCP, each sub-FCP, and each booster power supply.

2. Install a surge protective device for each initiating device circuit, notification appliance circuit, data, and signaling line circuit entering/leaving each building that is monitored by the FCP.

3. If permitted by the FCP manufacturer, install surge protective devices in the FCP cabinet.

4. If the FCP manufacturer does not allow surge protective devices to be installed within the FCP cabinet, install one or more metal enclosures near the protected fire alarm equipment. Provide separate enclosures for 120V and signal voltage devices, or provide one enclosure with a metal partition to separate the 120V from the signal voltage devices.

5. Install a single point ground bar in the enclosure for the surge protective devices. Bond the ground bar to the enclosure and to the power circuit equipment-grounding conductor. Connect each surge protective device to the ground bar with a separate 12 AWG solid, green-insulated, ground wire. Keep ground wires as short and straight as possible.

6. Install surge protective devices in accordance with manufacturer's instructions, keeping leads and ground conductors as short and straight as possible.

I. Identification

1. Label each conductor at each terminal and junction point. Use wire markers specified in Section 26 0553, Identification for Electrical Systems, On wire markers indicate the type of fire alarm circuit (e.g. Pull Stations, Fan Shutdown, Alarm Strobes, etc.).

2. Mark floor in front of cabinet(s) to show the NEC required working clearances according to Section 26 0553, Identification for-Electrical Systems.

3. Label fire alarm junction boxes with 2-1/4" x 1/2" (minimum size) pressure sensitive vinyl markers having "FIRE ALARM" in red letters on a white background.

4. Label all devices with address/zone information. Use self-adhesive vinyl labels with 3/4 inch (minimum) lettering easily visible without a ladder.

3.3 PAINTING

A. Exposed Surfaces: Paint exposed fire alarm conduit, panels, cabinets, pullboxes, supports, and other electrical equipment as follows:

1. Galvanized Surfaces: Paint for repairing galvanized materials shall be zinc-rich type.

2. Refinishing: Thoroughly clean and touch up shop primed or finish painted surfaces damaged in handling or installation with paint supplied with the equipment or an approved matching paint.

3. Interior Conduit: Paint new exposed interior conduit in rooms finished and/or occupied to match the existing background paint color. Paint conduit to be painted with one coat of primer. Paint conduit to match the existing background colors with two coats of paint to provide a minimum thickness of 6 mils.

3.4 EQUIPMENT INSTALLATION

A. Install devices or equipment not specifically covered by these specifications in accordance with manufacturer's instructions.

3.5 CONNECTION TO LANL CENTRAL STATION

A. Install 6 x 6 x 4 enclosure adjacent to the FACP with a conduit to the appropriate factory knockout.

B. Install a 3/4 inch conduit with measuring pull tape from the 6 x 6 x 4 enclosure to the main telecommunications room.

C. Install one GFE Category 5e telecommunications cable in the conduit and label each end of the cable as “emergency.”

D. LANL will terminate the telecommunications cable on two 8-pin RJ-31X telephone outlet jacks in a 2-port outlet that is mounted inside the 6 x 6 x 4 enclosure. LANL will label one jack as “primary,” and the other as “backup.”

E. LANL will terminate the telecommunications cable pairs to two separate lines (numbers) at the telecommunications room, selecting dedicated numbers or low-usage (lobby, conference room, etc), voice-grade, loop-start DTMF numbers that provide timed-release disconnect.

F. LANL will connect the “primary” and “backup” number ports on the DACT to the corresponding telephone outlet jacks.

3.6 CLEANING

A. Blow out junction boxes and fire alarm equipment not hermetically sealed with clear, dry, oil-free (15 psig maximum) air to remove dust and dirt prior to energizing.

3.7 FIELD QUALITY CONTROL

A. Provide the services of a qualified factory trained and certified technician for the FCP installed on this project. The factory technician shall assure the completeness and correctness of the installation by performing the following:

1. Prepare as-built documentation of FCP indicating location of components, interconnection of components, and connections to alarm initiating, indicating and auxiliary circuits.

2. Field verify and mark as-built shop drawings of fire alarm layout, conduit and wiring plans, and point-to-point field wiring diagrams.

3. Verify correct labeling of fire alarm system conductors.

4. Verify that conductor sizes are adequate for each alarm initiating, indicating and auxiliary circuit.

5. Prepare as-built battery load calculations.

6. Measure and adjust audible alarm signal in all spaces to comply with ADAAG requirements: minimum 15 dBA above ambient, but not over 120 dBA at any location.

7. Test all devices for proper supervision and alarm operation.

8. Test all interlocks with HVAC and elevator system for proper operation.

9. Perform pre-final acceptance inspections and tests of the fire alarm system modifications.

10. Prepare final acceptance test plan.

B. After the pre-final test, provide a report to the LANL Project Leader indicating the status of the fire alarm system and any corrective actions required before the acceptance tests.

C. Submit a detailed test plan for the final acceptance test.

1. Submit the test plan not less than 10 working days before the planned final acceptance date.

2. Follow test methods outlined in NFPA 72.

D. Submit FCP program at least two weeks prior to final acceptance test.

E. Submit final drawings, calculations, and manufacturer’s data at least one week prior to final acceptance test.

F. Coordinate date of final acceptance test with installer, HVAC sub-contractor, sprinkler sub-contractor, elevator controls sub-contractor, LANL Project Leader, and the LANL Fire Protection Group representative. Make corrective actions before final acceptance test date.

3.8 FINAL ACCEPTANCE TEST

A. NOTIFY CONTRACT ADMINISTRATOR AT a minimum of 2 weeks in advance of final acceptance tests. The more advance notice will help minimize scheduling conflicts and delays. Perform final acceptance tests in the presence of an authorized representative of the Contract Administrator and an authorized representative of the LANL Fire Protection Group.

B. Before the final acceptance test begins, present a preliminary copy of the Record of Completion to the authorized representative of the LANL Fire Protection Group.

1. Preliminary Record of Completion shall be of the form required by NFPA 72.

2. Indicate on the preliminary Record of Completion that the pre-final inspections and tests have been performed and all corrective actions have been completed.

3. The final acceptance test will not proceed before the Record of Completion is presented to the authorized representative of the LANL Fire Protection Group.

C. Perform final acceptance tests on the completed fire alarm system:

1. Follow the approved test plan and comply with NFPA 72 requirements.

2. Test FCP and the connected initiating, alarm, and auxiliary devices.

3. Perform 24-hour discharge test on the FCP batteries.

4. LANL will perform tests on connections made by LANL.

5. LANL Telecommunications Group will perform the acceptance test of the telephone lines from the modular plug connectors, to verify telephone line continuity and switch features before turning lines over to the LANL Fire Protection Group.

D. At the final acceptance test, have marked-up shop drawings and point-to-point wiring diagrams available for review and verification. Final acceptance test will not proceed without these as-built documents. If LANL verification of the as-built documents reveals errors, re-verify the complete fire alarm raceway and wiring system in the presence of a LANL Fire Protection Group representative.

E. Correct deficiencies discovered in the final acceptance test and re-test fire alarm system until satisfactory test results are obtained.

F. Upon successful completion of acceptance tests, submit a final “Record of Completion” and “Inspection and Testing Form” as required by NFPA 72.

G. Submit a “recommended spare parts” list for the installed fire alarm system, along with the Record of Completion.

3.9 SYSTEM IDENTIFICATION PLACARD

A. Furnish and install a permanently mounted placard in or adjacent to the fire alarm control cabinet.

B. Provide the following information typewritten or engraved on the placard:

1. Name, address and telephone number of installing contractor.

2. Reference to the standards, including date of issue to which the system conforms (e.g. NFPA 72 and NFPA 70, latest edition).

3. Circuit number of power supply to FCP and location of the electrical panelboard.

4. Location of fire alarm system Operating and Maintenance Instructions if they are not stored in the FCP cabinet.

5. Location of fire alarm system as-built documents.

END OF SECTION

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Do not delete the following reference information:
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FOR LANL USE ONLY

This project specification is based on LANL Master Specification 28 3100 Rev. 0, dated January 6, 2006.